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ABSTRACT

Computers are under-utilized by faculty members in higher education, despite the fact that recent advances have simplified usage. Many professors shy away from the computer because they lack understanding of its basic nature and they fear the unknown. Historically, the requirements that: 1) the user specify in advance information needed solely for internal use by the machine, and 2) that each program run in batch mode be embedded in a set of job control cards, combined to throw up a wall between the computer and the casual user. Stemmed from the failure to distinguish the nature of the problem (or algorithm) from the nature of the machine. This situation has changed recently as computer science advances have reduced the amount of detail needed for simple use, providing improved languages and procedures to do this work. Faculty members must now begin to approach and make use of faculties with teacher-programers who would introduce other teachers to computers, using interactive languages and moving from simple to more complex tasks. (PB)

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GETTING THE COMPUTER OUT OF THE TEMPLE AND INTO THE TEACHERS' LOUNGE

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WHY DO I CLAIM THAT THE COMPUTERS CURRENTLY INSTALLED AND PAID FOR IN THE ACADEMIC WORLD TODAY ARE NOT BEING UTILIZED TO THEIR FULL POTENTIAL? BECAUSE MANY WHO COULD PROFIT FROM THEIR USE CHOOSE NOT TO RATHER THAN TO FACE THE TASK OF LEARNING HOW. AND THIS AT A TIME WHEN THAT TASK IS BEING CONTINUALLY SIMPLIFIED AND REDUCED.

HISTORICALLY, THE COMPUTER AS A PHYSICALLY EXISTING MACHINE IN THIS, ITS ADOPTED HOMELAND, IS AS OLD AS I AM. IT HAS LONG SINCE PROVEN ITS FANTASTIC SPEED, ACCURACY, VERSATILITY, AND ALL AROUND USEFULNESS. THIS IN ITSELF HAS FORCED THE ADOPTION AND USE OF COMPUTER METHODS IN MANY PLACES; YET INTRIGUINGLY, THIS ADOPTION BY THOSE WHOM THE MACHINE SERVES AND BY THOSE WHO DEAL WITH THE MACHINE HAS OFTEN BEEN A RELUCTANT ADOPTION: MAN HAS HESITATED TO DEAL WITH THIS MACHINE, DISPLAYING AN ATTITUDE WHICH SEEMS AKIN TO FEAR. THE RESULT, AS BEST I CAN DETERMINE, OF A SUPERSTITIOUS IGNORANCE, OR RATHER LET US US SAY, A LACK OF UNDERSTANDING OF THE BASIC NATURE OF THE DEVICE (ALTHOUGH VIEWING IT AS SOME KIND OF 'BRAIN' OR LIVING THING HAS BEEN OVERCOME), AN IGNORANCE WHICH MANY CULTIVATE AND SHELTER CAREFULLY, AND A FEAR OR DISLIKE OF THE COMPLEXITY WHICH HAS TRADITIONALLY SURROUNDED THE ACCESS TO AND USE OF THE COMPUTER.

TO BRING THIS GENERALIZATION CLOSER TO HOME, THIS IGNORANCE AND RELUCTANCE TO LEARN SOMETHING NEW IS MOST SHAMEFUL IN THE FIELD OF EDUCATION, WHERE TEACHERS ALWAYS TELL THEIR STUDENTS TO KEEP LEARNING NEW THINGS AND ADAPTING TO NEW SITUATIONS. YET SEVERAL TEACHERS (AND TEACHERS OF TEACHERS) IN MY OWN INSTITUTION AND OTHERS NEARBY TURN TO ME, ALTHOUGH THIS IS NOT MY FIELD, TO EXPLAIN TO THEIR CLASSES SOME OF THE SIMPLE BASICS, YEAR AFTER YEAR, NOT TROUBLING TO LEARN IT THEMSELVES THAT THEY MIGHT TEACH IT THE NEXT TIME (WHICH IS STILL BETTER THAN THOSE WHO IGNORE IT TOTALLY). UNFORTUNATELY, THIS APPROACH IS NOT EVEN RESTRICTED TO 'OLDER' FACULTY MEMBERS.

OF EVEN MORE SPECIFIC INTEREST TO THIS ORGANIZATION, THIS PSYCHOLOGICAL ATTITUDE ON THE PART OF THOSE FACULTY WHO PREACH THE NEW, BUT TEACH THE OLD, LEADS TO THE ABANDONMENT BY MANY OF THEIR STUDENTS OF SOME OF THE MOST TRADITIONAL RESEARCH TOOLS AND TECHNIQUES AS BEING OF A COMPLEXITY SUCH THAT ONE WOULD NOT ATTEMPT TO USE THEM UNLESS FORCED, AND THIS IN AN ERA WHEN ALL THE DRUDGERY, COMPLEXITY, AND INDEED NEEDED BACKGROUND KNOWLEDGE OF HOW TO OBTAIN THE RESULTS (NOT INTERPRET THEM) CAN ALL BE HANDLED BY THE COMPUTER.

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THUS WHILE SUCH TECHNIQUES AS STANDARD DEVIATION ARE REQUIRED LEARNING FOR WOULD-BE TEACHERS, THEIR VIVID MEMORIES OF WADING THROUGH ENDLESS ARITHMETIC ON THE PRACTICE PROBLEMS WILL CAUSE MOST OF THEM TO SHY AWAY FROM ANY ATTEMPT TO UTILIZE THE TECHNIQUE AS A RESEARCH TOOL. SIMILARLY, THIS SEMESTER, IN THE BUSINESS DEPARTMENT OF ONE VENERABLE AND PRESTIGIOUS INSTITUTION ONE NIGHT'S ASSIGNMENT IN ONE COURSE CONSISTED OF DOING THREE PRACTICE PROBLEMS IN STANDARD DEVIATION BY HAND, ALTHOUGH THE INSTITUTION ACTS AS A REGIONAL COMPUTER CENTER. THE EMPHASIS SEEMS TO BE ON THE MECHANICS, WHICH A COMPUTER CAN REDUCE TO THE MERE NAMING OF THE APPROPRIATE LIBRARY ROUTINE, RATHER THAN ON THE INTERPRETATION AND APPLICATION OF THE RESULTS OF THOSE MECHANICS. IT ALSO SEEMS TO BE A GOOD EXAMPLE OF THE MODERN FACULTY, WHERE THE LEFT HAND DOES NOT KNOW WHAT THE RIGHT HAND IS DOING.

ALL THIS LEADS OF COURSE TO THE QUESTION 'IF THE COMPUTER CAN SO EASILY HANDLE THE DRUDGERY, COMPLEXITY, AND ENDLESS REPETITION OF SUCH LONG COMPUTATIONS, WHY THE RELUCTANCE TO USE IT?' BESIDE THE QUICK PARRY CLAIMING COMPLETE IGNORANCE OF THE POTENTIAL, AND THE OBVIOUS REQUIREMENT OF LEARNING A COMPUTER 'LANGUAGE' AND THE TYPE OF 'THINKING' OR ORGANIZATION WHICH GOES INTO A COMPUTER PROGRAM, THERE ARE TWO RELATED PROBLEMS WHICH GO BEYOND THE DEFINING OF AN ALGORITHM IN PROGRAM FORM: THEY BOTH RESULT FROM A HISTORICAL FAILURE TO COMPLETELY SEPARATE THE NATURE OF THE PROBLEM (THE ALGORITHM) FROM THE NATURE OF THE MACHINE WHICH WILL EXECUTE THE DEFINED INSTRUCTIONS. THE FIRST IS THE REQUIREMENT BY MANY PROGRAMMING LANGUAGES THAT THE USER SPECIFY IN ADVANCE VARIOUS TIDBITS OF INFORMATION NEEDED FOR PURELY INTERNAL USE BY THE MACHINE (DATA TYPE, MAXIMUM SPACE REQUIREMENTS, ETC.), SOMETHING THAT MANY OF THE NEWER LANGUAGES HANDLE BY THEMSELVES, EVEN TO THE POINT OF ALLOWING 'FREE FIELD FORMATTING' GREATLY LESSENING THE NEED FOR THE HIDEOUSLY EXACTING ALIGNMENT OF DATA INTO PRECISELY THE EXPECTED COLUMN, ETC. THE SECOND SUCH PROBLEM IS A REPEAT OF THE FIRST, BUT ON ANOTHER LEVEL: EACH PROGRAM RUN IN 'BATCH MODE' IN A MODERN COMPUTER CENTER MUST BE EMBEDDED IN A SET OF 'JOB CONTROL CARDS', WITH A MULTITUDE OF OPTIONS AGAIN IN TERMS OF THE MACHINE, RATHER THAN THE PROBLEM. THIS HAS ITS HISTORICAL ROOTS IN THE INCREASING USE OF THE COMPUTER IN THE EARLY DAYS, WHICH LED TO THE 'CLOSED SHOP' OPERATION OF THE COMPUTER BY TRAINED 'COMPUTER OPERATORS', THOSE WHO KEEP THE MACHINE RUNNING AND FEED IN THE PROGRAMMER'S INSTRUCTIONS, ALTHOUGH THEY MAY NOT BE PROGRAMMERS THEMSELVES. AS THE WORKLOAD INCREASED, CAREFUL SCHEDULING BECAME NECESSARY TO ENSURE MAXIMUM 'THROUGHPUT', AND THE COMPLEX SYSTEM OF QUEUING AND PRIORITIES WAS INEVITABLY COMPUTERIZED. THE CONTROL CARDS ARE THE INPUT DATA FOR THE 'SUPERVISOR PROGRAM' WHICH HANDLES SO MUCH OF WHAT THE OPERATOR ONCE HAD TO DO BY HAND. HERE AGAIN, THE CURRENT TREND IS IN THE DIRECTION OF SIMPLIFYING THINGS FOR THE USER BY PREDEFINING 'PROCEDURES' OR COMMONLY USED CONTROL COMBINATIONS, ALLOWING THE NON-SPECIALIST TO SPECIFY A COMPLEX PACKAGE BY MERELY NAMING THE PROCEDURE, THE DETAILS OF WHICH ARE THEN CALLED UP BY THE COMPUTER FROM ITS MEMORY BANKS.

CLEARLY THE INCREASING COMPLEXITY SURROUNDING THE ACCESS TO

THE MACHINE AND THE VARIED WAYS IN WHICH IT IS USED HAD BECOME A CONSIDERABLE BARRIER TO ANYONE NOT THOROUGHLY CONVINCED THAT THE RESULTS JUSTIFIED THE EXPENDITURE OF TIME AND EFFORT. SUCH A PERSON WOULD HAVE TO HAVE A FAIRLY CLEAR NOTION OF WHAT THE MACHINE COULD DO FOR HIM BEFORE HE BEGAN. THERE SEEMED TO BE NO PLACE FOR THE 'CASUAL' COMPUTER USER. YET IT IS RARE THAT ANYONE ELSE KNOWS YOUR INTERESTS AND ACTIVITIES WELL ENOUGH TO TELL YOU EVERYTHING THAT THE COMPUTER COULD DO FOR YOU.

CLEARLY AN IMPORTANT FIRST STEP TOWARD COMPROMISE HAS BEEN MADE BY THE COMPUTER WORLD: THEY HAVE SIMPLIFIED NOT THE MACHINE, BUT THE AMOUNT OF DETAIL NEEDED FOR SIMPLE USE. THE NEWER LANGUAGES DO MORE OF THE WORK. THE USE OF PROCEDURES SIMPLIFIES ACCESS. THE DEVELOPMENT OF 'INTERACTIVE' LANGUAGES EVEN REDUCES OR ELIMINATES THE PROBLEM OF 'TURNAROUND TIME', THE LAG BETWEEN THE SUBMISSION OF THE PROGRAM AND THE RETURN OF THE RESULTS.

THE REMAINING PROBLEM, THEN, IS TO GET THE POTENTIAL USER TO COME THE REMAINING DISTANCE, TO MAKE HIM AWARE OF WHAT THE COMPUTER CAN DO FOR HIM (EVEN IN NON-NUMERICAL FIELDS, SUCH AS ADVANCED STUDIES IN MUSICAL NOTATION, OR THE COMPOSITION OF MULTIPLE-CHOICE QUESTIONS IN FRENCH GRAMMAR), IN A WORD THE SEDUCTION OF THE FRIGHTENED FACULTY MEMBER.

MY SUGGESTION IS TO HAVE THE SCHOOL PROVIDE A PROGRAMMER/TEACHER WHO CAN TEACH THE STUDENTS IN CLASSES, AND PROGRAM FOR THE FACULTY, ESPECIALLY LITTLE CONVENIENCE PROGRAMS, EVEN MORE THAN HUGE UNDERTAKINGS. THINGS TO WHET THE INTEREST OF THE FACULTY: GRADE AVERAGES, ITEM ANALYSIS TABLES FOR MULTIPLE-CHOICE TESTS, PERHAPS EVEN CORRECTING THE PAPERS AS IT GOES ALONG (MINE ALSO CHECKS FOR EXCESSIVE ABSENCES AND MAKES SNIDE COMMENTS RELATED TO THE GRADE ACHIEVED); START SIMPLY AND SLOWLY ADD MORE FEATURES AS THE FACULTY MEMBER BECOMES AWARE BY TALKING TO HIS PROGRAMMER THAT SUCH THINGS ARE POSSIBLE. THIS CAN LEAD ALL THE WAY TO COMPUTER ASSISTED INSTRUCTION (C.A.I.), WHICH NEED NOT BE RESTRICTED TO NUMERICAL TYPES OF SUBJECT MATTER.

BUT IT IS IMPORTANT TO START OFF SIMPLY, SAY JUST A SIMPLE PROGRAM TO AVERAGE THE NUMBERS FED TO IT. LATER, THIS CAN BE ELABORATED INTO A WEIGHTED AVERAGE, OR ONE WORKING FROM NUMBERS WHICH HAVE ALREADY BEEN STORED AND NEED NOT BE HANDFED TO THE PROGRAM (E.G. GRADES IN AN AUTOMATED ROLLBOOK, PLACED THERE BY THE MACHINE WHEN IT GRADED THE TEST, ASSUMING MULTIPLE-CHOICE).

THE PROGRAMMER IS OF COURSE SOMETHING OF A TROJAN HORSE: ONCE THE 'USERS' OF A PACKAGED CONVENIENCE HAVE BECOME LESS APPREHENSIVE ABOUT SITTING AT THE MACHINE TO FEED IN THEIR DATA, HAVING LEARNED JUST ENOUGH OF THE RUDIMENTS FOR THE PURPOSE, HOW TO TURN IT ON, HOW TO INVOKE THE PROGRAM THEY WISH TO USE, WHICH SOMEONE ELSE HAS WRITTEN, THEN THEY MUST BE SUBTLY LED TOWARD SEEING HOW SOME PART OF IT WORKS. HERE, FOR THE FIRST TIME, LET ME RECOMMEND THAT AN INTERACTIVE COMPUTER LANGUAGE CAN BE USED TO BEST ADVANTAGE FOR SUCH A SEDUCTION. MY OWN PREFERENCE IS APL. WHILE DISCUSSING THE PROBLEM TO BE PROGRAMMED 'FOR' THE

WOULD BE USER. THE PROGRAMMER CAN USE THE MACHINE AS AN ADVISOR FOR PRELIMINARY CALCULATIONS, AND TOSS IN AN OFF-HAND COMMENT ON HOW IT FACILITATES BALANCING ONE'S CHECKBOOK. AND PERHAPS SHOWING THE 'CUSTOMER' HOW EASY SIMPLE ADDITION AND SUBTRACTION ARE... SUCH TACTICS MAY WELL WEAKEN THE STRONGEST RESISTANCE, BUT THEY MUST NOT BE RUSHED.

THE ADVANTAGE OF THE INTERACTIVE LANGUAGE HERE IS LARGELY THAT OF IMMEDIATE RESPONSE AND BEING ABLE TO FUNCTION IN PART WITHOUT AN OVERALL KNOWLEDGE OF THE ENTIRE LANGUAGE, GIVING AN IMMEDIATE REWARD AND FEELING OF ACCOMPLISHMENT, WHICH WILL USUALLY LEAD TO FURTHER EXPLORATION. AFTER ALL, PROGRAMMING CAN BE FUN: AS THE OLD FRENCH PROVERB PUTS IT, ''L'APPETIT VIENT EN MANGEANT.'' USING COMPUTERS ON SMALL THINGS (CALCULATING GAS MILEAGE, ETC.) LEADS TO A FAMILIARITY WITH THE CAPABILITIES, AND THENCE TO THE TEMPTATION TO ENLIST ITS AID IN MORE AMBITIOUS UNDERTAKINGS.

''ANY STUDENT WHO DOES NOT BECOME CONVERSANT WITH COMPUTERS RISKS BEING A LINGUISTIC CRIPPLE IN TOMORROW'S WORLD,'' SAYS DEAN PRANGE OF THE UNIVERSITY OF WISCONSIN. BUT CAN THIS BE LIMITED TO STUDENTS? ARE THEY THE ONLY ONES WHO WILL BE LEFT TOMORROW?

LASTLY, BEFORE CLOSING, I SHOULD LIKE TO THANK THE COMPUTER WHICH HELPED ME EDIT THIS PAPER.